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10/540,734	01/23/2006	Toshikazu Hashimoto	14321.78	9162

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EXAMINER	
STAHL, MICHAEL J	

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2874	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/540,734	HASHIMOTO ET AL.	
	Examiner	Art Unit	
	Mike Stahl	2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 July 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *58-68 and 80-119* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *58-68 and 80-119* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 June 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *5/5/06,7/12/06,4/30/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Election

Applicant's election without traverse of group I (claims 58-68, 80-119) in the reply filed on July 25, 2007 is acknowledged.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 59 and 80-119 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 59 is indefinite because line 4 refers to "phase conjugation of at individual points". It appears that there is a word missing after "of" in that phrase.

Claim 80 is indefinite because it refers to "the input port" and "the incident light" but no input port or incident light was previously mentioned in this claim. Claims 81-82 are indefinite by dependence from claim 80. For the purpose of comparison with prior art in this action, claim 80 will be treated as if it recites "an input port" and "incident light".

Claim 83 is indefinite because it refers to "the input port" and "the incident light" but no input port or incident light was previously mentioned in this claim. For the purpose of comparison with prior art in this action, claim 83 will be treated as if it recites "an input port" and "incident light".

Claim 84 is indefinite because it refers to "the input port", "the incident light", and "said substrate" but no input port or incident light or substrate was previously mentioned in this claim.

Claims 85-114 are indefinite by dependence from claim 84. No meaningful comparison of claim 84 to the prior art can be made at this time since it is not clear how applicant will amend the claim to structurally relate a substrate to the other recited elements.

Claim 86 is indefinite because it refers to "said unit lattice", but no unit lattice is mentioned in its parent claims.

Claim 89 is indefinite because it is not known what is meant by "average distance of radiation components". The distance to what or from what is unspecified.

Claim 93 is indefinite because it refers to "the region defined by the virtual mesh", but no region was specifically mentioned in parent claim 84.

Claim 94 is indefinite because it refers to "said waveguide region", but no waveguide region was mentioned in parent claim 84. Claim 95 is indefinite by dependence from claim 94.

Claim 96 is indefinite because it refers to "said waveguide region", but no waveguide region was mentioned in parent claim 84. Claims 97-101 are indefinite by dependence from claim 96.

Claim 104 is indefinite because it refers to "said sub-pixels", but no sub-pixels were mentioned in its parent claims.

Claim 105 is indefinite because it refers to "said sub-pixels", but no sub-pixels were mentioned in its parent claims.

Claim 106 is indefinite because it recites that phases of signals are perpendicular to each other. It appears that this might mean that the signals are 90 degrees out of phase with each other. If so, "perpendicular" should be changed to "at 90 degrees" to make this meaning clear. Claims 107-108 are indefinite by dependence from claim 106.

Claim 109 is indefinite because it recites that phases of signals are not perpendicular to each other. It appears that this might mean that the signals are not 90 degrees out of phase with each other. If so, "perpendicular" should be changed to "at 90 degrees" to make this meaning clear. Claims 110-111 are indefinite by dependence from claim 109.

Claim 112 is indefinite because it recites that phases of signals are adjusted to be aligned with each other. It appears that this might mean that the phases of the signals are mutually equal. If so, "aligned with" should be changed to "equal to" to make this meaning clear. Claim 113 is indefinite by dependence from claim 112.

Claim 114 is indefinite because it refers to "the output light", but no output light was mentioned in parent claim 84.

Claim 115 is indefinite because it refers to "the input port" and "the incident light" but no input port or incident light was previously mentioned in this claim. Claims 116-119 are indefinite by dependence from claim 115. For the purpose of comparison with prior art in this action, claim 115 will be treated as if it recites "an input port" and "incident light".

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an

international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 58, 60, 62-63, 68, 80, and 82 are rejected under 35 U.S.C. 102(b) as being anticipated by Hirota et al. (US 5822475).

Claim 58: Hirota discloses a wave transmission medium for outputting incident light that is launched into an input side port **25** to a desired output side port **25**, said port being defined as a location of a circuit at which a cross section having desired optical input/output is given, the wave transmission medium comprising: a spatial refractive index distribution determined such that the incident light launched into the input port propagates through the wave transmission medium with scattered multiple times **21a**; wherein local positions in the wave transmission medium are designated by virtual pixels defined by a virtual mesh, and the spatial refractive index distribution of the wave transmission medium is formed by refractive indices of the individual pixels (fig. 6). It is noted that "virtual pixels" and "virtual mesh" are arbitrarily defined. Any optical device can be modeled as a collection of discrete pixels with each pixel having an associated refractive index.

Claim 60: The device in Hirota includes scatterers **21a** having one refractive index, dispersed in a medium **21** having a different refractive index (col. 8 lns. 61-67). Accordingly the device can be modeled as mentioned above, with each pixel taking either of two possible refractive index values.

Claim 62: Two is a finite number. Claim 62 does not specify that "between" the lower limit and upper limit is exclusive of the limits themselves.

Claim 63: The refractive index distribution is determined such that the incident light launched into the input port is split to different output port locations at a desired ratio. Since the

device is designed to diffuse input light to the output ports, the output ports receive a desired amount of the input light.

Claim 68: The wave transmission medium is composed of a dielectric.

Claim 80: The fig. 6 Hirota device is a waveguide circuit, with the wave transmission medium placed in two dimensions.

Claim 82: The fig. 6 Hirota device is regarded as an optical bending circuit because it enables transfer of light from any port to any of the other ports, and none of the ports are mutually coaxial.

Claims 58, 60-63, 68, and 80-82 are rejected under 35 U.S.C. 102(a) as being anticipated by Mašanović et al. (article in Photonics Technology Letters 15(5):706, May 2003).

Claim 58: Masanovic discloses a wave transmission medium for outputting incident light that is launched into an input side port to a desired output side port, said port being defined as a location of a circuit at which a cross section having desired optical input/output is given, the wave transmission medium comprising: a spatial refractive index distribution determined such that the incident light launched into the input port propagates through the wave transmission medium with scattered multiple times; wherein local positions in the wave transmission medium are designated by virtual pixels defined by a virtual mesh, and the spatial refractive index distribution of the wave transmission medium is formed by refractive indices of the individual pixels (fig. 1(a)). It is noted that "virtual pixels" and "virtual mesh" are arbitrarily defined. Any optical device can be modeled as a collection of discrete pixels with each pixel having an

associated refractive index. It is also noted that fig. 1(b) shows results of simulation of the fig. 1(a) structure by a beam propagation method.

Claim 60: The Masanovic device can be modeled as having pixels of higher refractive index (the shaded portions of fig. 1(a)) and pixels of lower refractive index (surrounding medium, e.g. air).

Claim 61: The pixels with low refractive index have an existing probability of equal to or less than 30% in a propagation direction of the incident light in the wave transmission medium (light is substantially confined to the high refractive index regions).

Claim 62: Two is a finite number. Claim 62 does not specify that "between" the lower limit and upper limit is exclusive of the limits themselves.

Claim 63: The refractive index distribution is determined such that the incident light launched into the input port is split to different output port locations at a desired ratio (50% to each output port, see e.g. third paragraph of section II or fig. 4(b)).

Claim 68: The wave transmission medium is composed of a dielectric.

Claim 80: The Masanovic device is a waveguide circuit, with the wave transmission medium placed in two dimensions.

Claim 81: The fig. 1(a) waveguide circuit constitutes a multimode interference circuit.

Claim 82: The waveguide circuit is regarded as an optical bending circuit because it enables transfer of light from any port to any of the other ports, and none of the ports are mutually coaxial (also note e.g. third sentence of third paragraph of section II).

Claims 58, 60, 62-63, 66-68, 80 and 82 are rejected under 35 U.S.C. 102(e) as being anticipated by Gunn et al. (US 7006732).

Claim 58: Gunn discloses a wave transmission medium for outputting incident light that is launched into an input side port to a desired output side port, said port being defined as a location of a circuit at which a cross section having desired optical input/output is given, the wave transmission medium comprising: a spatial refractive index distribution determined such that the incident light launched into the input port propagates through the wave transmission medium with scattered multiple times; wherein local positions in the wave transmission medium are designated by virtual pixels defined by a virtual mesh, and the spatial refractive index distribution of the wave transmission medium is formed by refractive indices of the individual pixels (fig. 1). It is noted that "virtual pixels" and "virtual mesh" are arbitrarily defined. Any optical device can be modeled as a collection of discrete pixels with each pixel having an associated refractive index.

Claim 60: The Gunn device can be modeled as having pixels of higher refractive index and pixels of lower refractive index, since the scatterers **106** have one refractive index, and the surrounding material such as air has a different refractive index (figs. 4/5).

Claim 62: Two is a finite number. Claim 62 does not specify that "between" the lower limit and upper limit is exclusive of the limits themselves.

Claim 63: The refractive index distribution is determined such that the incident light launched into the input port is split to different output port locations (end of waveguides **123** or **113**) at a desired ratio.

Claim 66: The incident light launched into the input port is polarization multiplexed light with a TE mode and a TM mode, and the refractive index distribution is determined such that the polarization multiplexed light is demultiplexed to different output port locations depending on individual polarized waves of the polarization multiplexed light.

Claim 67: The incident light launched into the input port is polarization multiplexed light with a TE mode and a TM mode, and the refractive index distribution is determined such that individual polarized waves of the polarization multiplexed light are demultiplexed and split to different output port locations at a desired ratio.

Claim 68: The wave transmission medium is composed of a dielectric.

Claim 80: The Gunn device is a waveguide circuit, with the wave transmission medium placed in two dimensions.

Claim 82: The waveguide circuit is regarded as an optical bending circuit because it enables transfer of light from any port to any of the other ports, and none of the ports are mutually coaxial.

Claims 58, 60, 62-65, 68, 80, and 82-83 are rejected under 35 U.S.C. 102(e) as being anticipated by Levner et al. (US 2006/0051022).

Claim 58: Levner discloses a wave transmission medium for outputting incident light that is launched into an input side port to a desired output side port, said port being defined as a location of a circuit at which a cross section having desired optical input/output is given, the wave transmission medium comprising: a spatial refractive index distribution determined such that the incident light launched into the input port propagates through the wave transmission

medium with scattered multiple times; wherein local positions in the wave transmission medium are designated by virtual pixels defined by a virtual mesh, and the spatial refractive index distribution of the wave transmission medium is formed by refractive indices of the individual pixels (fig. 4). It is noted that "virtual pixels" and "virtual mesh" are arbitrarily defined. Any optical device can be modeled as a collection of discrete pixels with each pixel having an associated refractive index. Levner actually describes the fig. 4 device in terms of a two-dimensional array of pixels having a particular refractive index ([0100]).

Claim 60: The fig. 4 device in basic form is a "binary supergrating" which means that its pixels have only two possible refractive index values.

Claim 62: Two is a finite number. Claim 62 does not specify that "between" the lower limit and upper limit is exclusive of the limits themselves. However, Levner also teaches that the refractive index can take on more than two values ([0100] "finite set of two or more levels" or [0101] "non-binary").

Claim 63: The refractive index distribution is determined such that the incident light launched into the input port is split to different output port locations at a desired ratio.

Claim 64: The incident light launched into the input port is wavelength division multiplexed light composed of a plurality of wavelengths, and the refractive index distribution is determined such that the optical waves are demultiplexed to different output port locations depending on the individual wavelengths of the wavelength division multiplexed light. Also note fig. 16.

Claim 65: The incident light launched into the input port is wavelength division multiplexed light composed of a plurality of wavelengths, and the refractive index distribution is

determined such that the wavelength division multiplexed light are demultiplexed and split to different output port locations at a desired ratio.

Claim 68: The wave transmission medium is composed of a dielectric.

Claim 80: The Levner device is a waveguide circuit, with the wave transmission medium placed in two dimensions.

Claim 82: The waveguide circuit is regarded as an optical bending circuit because it enables transfer of light from the input port to any of the output ports, two of which are not mutually coaxial. Also note the basic curved waveguide of fig. 41.

Claim 83: The spatial refractive index distribution may be implemented by local refractive index variations of the waveguide circuit based on electrooptic effect ([0134]-[0135]).

Allowable Subject Matter

Claims 115-119 would be allowable if claim 115 is amended to overcome the above indefiniteness rejection. The prior art of record does not disclose or suggest modifying a conventional arrayed waveguide grating by including in a connecting region between the input waveguide and the first slab waveguide a plurality of scattering points having a higher refractive index than that of the input waveguide.

Conclusion

The additional references listed on the attached PTO-892 form are relevant to the subject matter of this application.

Inquiries about this letter may be directed to examiner Stahl at the number below. Inquiries of a general or clerical nature (e.g., a request for a missing form or paper, etc.) should be directed to the technical support staff supervisor at 571-272-1626. Official correspondence which is eligible for submission by facsimile and which pertains to this application may be faxed to 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Questions about the Private PAIR system should be directed to the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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September 25, 2007

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